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■ Recibido / Received
15 de febrero de 2020

■ Aceptado / Accepted
25 de febrero de 2020

■ Páginas / Pages
De la 81 a la 91

■ ISSN: 2531-0054

Artificial Intelligence & Machine Learning: a model for a new judicial system?

Inteligencia artificial y *machine learning*: ¿un modelo para un nuevo sistema judicial?

Artificial Intelligence and Machine Learning are a result not only of technological advances but also of the exploitation of information or data, which has led to its expansion into almost all aspects of modern life, including law and its practice. Due to the benefits of these technologies, such as efficiency, objectivity, and transparency, the trend is towards the integration of Artificial Intelligence and Machine Learning in the judicial system. Integration that is advocated at all levels and, today, has been achieved mostly under the implementation of tools to assist the exercise of the judiciary. The «success» of this integration has led to the creation of an automated court or an artificially intelligent judge as a futuristic proposal.

Bearing in mind this proposal of complete integration of Artificial Intelligence and Machine Learning in the judicial system. The query on this note is to present how the human component in the judiciary, attributed to the cognitive processes of the mind of the judge, is essential to the evolution of society, because, without the ability to forget or unlearn that has the human being, we could not have recognized the rights of the child or the women, and overcome racial and ethnic segregation. So, until Artificial Intelligence and Machine Learning have simulated this cognitive process in the technology, an automated court or an artificially intelligent judge is a futuristic idea unless it is decided to completely reevaluate the role of the judge and the judicial system in our societies, which supposes redesigning the system or designing a new one.

KEY WORDS: judicial system, judge, dispute resolution mechanism, artificial intelligence, machine learning, automated court, cognitive process.

La inteligencia artificial y *machine learning* son el resultado de los avances de la tecnología y de la explosión de datos, que ha llevado a su extensión a casi todos los aspectos de la vida moderna, entre ellos el Derecho y su práctica. Debido a los beneficios atribuidos a estas tecnologías, tales como eficacia, objetividad y transparencia, la tendencia se dirige a la integración de inteligencia artificial y *machine learning* en el sistema judicial. Integración que se propugna a todos los niveles y que, hoy en día, se ha alcanzado en su mayor parte bajo la implementación de herramientas de ayuda al ejercicio del poder judicial. El «éxito» de dicha integración ha conducido a plantearse como propuesta futurista la creación de una corte automatizada o un juez artificialmente inteligente.

El propósito de esta nota es presentar cómo el componente humano en el poder judicial, atribuido a los procesos cognitivos de la mente del juez, es esencial para la evolución de la sociedad, pues, sin la capacidad de olvidar o desaprender, no habríamos podido reconocer los derechos de los niños y de la mujer, y superar la segregación racial y étnica. Por lo que, hasta que la inteligencia artificial y *machine learning* hayan desarrollado la simulación de este proceso cognitivo, una corte automatizada o un juez artificialmente inteligente deben seguir siendo unas ideas futuristas, a menos que se decida reevaluar completamente el papel del juez y del sistema judicial en nuestras sociedades, lo que implica el rediseño del sistema o el diseño de uno nuevo.

PALABRAS CLAVE: sistema judicial, juez, mecanismo de resolución de conflictos, inteligencia artificial, *machine learning*, corte automatizada, proceso cognitivo.

1. Introduction

There is no doubt that Artificial Intelligence (A.I.) and Machine Learning (M.L) impact every aspect of our lives, nowadays; and the legal profession is not exempt from the said impact. Many new applications are being designed and developed to facilitate the practice of law or to make it more efficient. It is the reason why Artificial Intelligence and Machine Learning are part of the future of the judiciary, without any doubt.

The discourse surrounding the future of the judiciary involves the integration of A.I. systems and Machine Learning to its way of operation. The integration of A.I. Systems and Machine Learning are not a futurist idea, there are already many different technologies integrated into the operation of the judiciary around the globe, like recidivism prediction in the criminal context, predictive justice, and many others. In light of the already integrated technologies, their proven success, and efficiency, the idea of an AI judge or an automated court is a natural consequence, although those technologies raise numerous concerns.

To begin, an automated court and A.I. judge need to be considered as a new Dispute Resolution Mechanism (DRM), which should not be only envisioned considering the principles of alternative dispute resolution design but also the role of the judge, like DRM, in our communities or societies. One of the important components to consider is that a court or a judiciary system relies on the human element, the judge, who naturally possesses cognitive skills essential in the adjudication of disputes, and one of those skills is the capacity to forget or unlearn. This capacity to forget or unlearn has been key to the evolution of our communities or societies. For example, a judge who lacks the capacity to forget or unlearn the prejudices and socio normative standards of their time would have been unable to decide against gender discrimination, segregation, and many other societal ills that have plagued human history.

The capacity to forget or unlearn in Artificial Intelligence and Machine Learning is a complicated discussion. It remains unknown whether the cognitive process required to forget or unlearn can be designed or developed. Some research studies show that it is possible, but testing is still undergoing, which indicates that it will be possible in the future. Thus, an automated court or A.I. Judge without this capability should be an important consideration, due to the concern that it raises unless the role of the judiciary in the future is also redefined.

First, I will present a simple and brief description of what is Artificial Intelligence and Machine Learning, the state of the art. Second, I will present the discussion that when designing an automated court or A.I. Judge, its design requires a combination of the principles and methodologies of both the law and computer science. Third, I will briefly present the

benefits and risk in light of the principles to be considered when designing a dispute resolution mechanism. Fourth, I will introduce the model used by Chinese Internet courts as an idea of implementing Artificial Intelligence and Machine Learning to create an automated court. Thus, an A.I. judge or automated court is not a futuristic idea, it is a reality, that needs to be properly evaluated. As with any powerful technology, Machine Learning raises questions about which of its potential uses in society should encourage and discourage [1].

2. Artificial Intelligence and Machine Learning: a new model for the Judicial System?

Artificial Intelligence and Machine Learning have expanded not only on the side of engineering but also on the side of the application. It is used in different industries, including health care, education, marketing, policing, manufacturing, film making and obviously the legal sector. Because we cannot slow down or lose the agility obtained by digital technology, the legal community needs to push the frontiers, spark the pioneering spirit and develop solutions quickly [2], which can only be achieved by considering and understanding the status of the technology and the role of the law, and especially the judicial system, in light of this transformation. It is why in a simple and brief explanation; I develop these concepts as I consider its implications for its integration and application in the future of the judicial system.

2.1. What is an Artificial Intelligence Algorithm?

Artificial Intelligence has not been precisely defined; it can be understood as a technology that seeks, as Alan Turing said: the computer potential not to replicate human thought process themselves, but rather external manifestations of those processes [3]. Considering this initial understanding and the status of the technology today, Artificial Intelligence is conceptualized as a system: a machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments [4].

Artificial Intelligence technology or system¹ functions by using machine and/or human-based inputs to i) perceive real and/or virtual environments; ii) abstract such perceptions into models through analysis in an automated manner (e.g. with M.L., or manually); and iii) use model inference to formulate options for information or action [4]. All of these models have led to a form of a technology called Machine Learning, that goes beyond the prediction paradigm, it is concerned with computer programs that learn from experience and improve their performance over time [5] and it enjoys a level of autonomy.

2.2. What is Machine Learning?

Machine Learning is one of the fastest-growing technologies in the area of computer science, despite the fact that is not new since most date back to the '70s, '80s, and '90s. Machine

1. AI technology or system are used interchangeable in this context.

Learning, meanwhile, is the «science of getting computers to act without being explicitly programmed.» [6] That is, rather than a computer programmer writing all the instructions that a computer should perform to reach a decision or result, the programmer provides a set of training data (e.g., example inputs and expected results for each) and executes a generalized algorithm by which the computer analyzes data to discern patterns –i.e., to «learn»– so that the computer can produce further results [7].

An algorithm is a set of instructions, which are followed to complete a task. For example, algorithms written to make credit score recommendations are exposed to historical data on people's profiles, on whether they repaid loans (machine-based inputs) and a set of rules (human-based inputs). With these two sets of inputs, the system perceives real environments: whether people are repaying loans on an ongoing basis, and relying on the use of a statistical model, it makes an inference (the credit-scoring algorithm) to formulate a recommendation (a credit score) of options for outcomes (providing or denying a loan) [4]. Thus, many algorithms focus on a task embodied in a function, and the learning problem is to improve the accuracy of that function, with experience consisting of a sample of known input-output pairs of the function [8].

As such Machine Learning represents one method for helping an algorithm achieve artificial intelligence. It contains numerous techniques that have been used by economists, researchers and technologists for decades. These range from linear and logistic regressions, decision trees and principle component analysis to deep neural networks [4]. Nowadays, Machine Learning sits at the crossroads of computer science, statistics and a variety of other disciplines concerned with automatic improvement over time, and inference and decision-making under uncertainty [9].

The development of the technology and the explosion of data have triggered the development of many different formalizations of Machine Learning, an A.I. method [7]. A common type of Machine Learning algorithm used today is an artificial neural network, which imitates the human brain [10]. Neural networks are simply abstract mathematical relationships between factors, which allow for a learning method. Learning systems generally map their data by producing output for each input; mapping that is achieved by different methods like decision trees, decision forests, logistics regression, among others. Thus, a diversity of methods for learning provides for the extended application of this kind of Machine Learning to great and different amounts of data.

3. Designing a dispute resolution system – Computer science and the law?

In recent years, Artificial Intelligence has made extraordinary inroads into the practice of law. This involvement in the law is an evident consequence of the way Artificial Intelligence operates, through predictions, recommendations, or suggestions through different models. A.I. automatically detects patterns in data and makes predictions based on them [11], which is not that different from the principles of logic followed during the application of the law, or particularly the called: legal syllogism paradigm. As the legal syllogism paradigm consists on a deductive analysis based on major premise that leads to the minor premise; when applying

the rule of law to a particular case, the judge detects the pattern on the set of facts, which allows a «prediction» or discharge of the minor premise. However, the deductive analysis instructing the adjudication of a dispute or the application of the law goes beyond the mere application of the principles of logic and the deductive analysis. Even though, the law system, especially its application, continues to rely on the legal syllogism paradigm, the predictions based on the syllogism paradigm takes into account the human component of the legal system. It is the humanity, implicating the free will, the morality and the knowledge, that are accounted within the role of the judge in our societies, which allows for the adjudication of the dispute in the historical and social context, and it is trusted with the power to affect the lives of others, despite the margin of error. As such, the role of the judge, the constant that evolves over time, demonstrates why our societies value the judicial system as the institution that promotes justice and not as an institution that is a direct manifestation of justice [12]. Therefore, the integration of A.I. and M.L. in the judiciary, through the form of an A.I. Judge or an automated court goes beyond the simple implementation of technology; it implicates the design of a dispute resolution system at most, or the redesign of the existent dispute resolution system, called: the judicial system, at minimum.

When designing an automated court or A.I. Judge, as theorists argue, the designer needs to consider the expectations of the community or society, the skills and resources needed by the new mechanism, and the motivation for the user [13]. More importantly, when designing a new judicial system or redesigning the existent judicial system, three principles need to be heightened: fairness, impartiality, and effectiveness [14], otherwise, the trust on the judiciary would fade. Additionally, designing an automated court and A.I. judge supposes to understand that Artificial Intelligence has a life cycle of four stages: 1) Design, data, and modeling, 2) Verification and validation, 3) Deployment and 4) Operation and monitoring [1]. Expansively, the life cycle includes the identification of the data, the gathering of the data, the identification and/or creation of the models or algorithms, the training of the algorithms, the testing, the live implementation and the process of assessing the algorithms' results. Thus, the design supposes a combination of the creative process from both the computer science and legal science to transpire the application of the principles of alternative dispute resolution design during the life cycle of an Artificial Intelligence algorithm and Machine Learning.

In light of the combined process, I would argue that designing an automated court or an A.I. judge supposes the consideration of a key component, the capability of Artificial Intelligence to achieve the cognitive process of forgetting or unlearning because a judge or a judicial system, which lacks this capability would perpetuate the legal system, on an old set of data (Inputs) and a defunct resolution (Outputs). Even though an individual judge is not the sole engine of societal change, the adjudication of singular controversies marks the path for the evolution of norms and rules.

Additionally, as the legal system functions based on the pre-established set of rules and norms in a particular socio, cultural and historical context and values; and that humanity evolves faster than the rules and norms, it is the judiciary who is confronted, sometimes, with disputes that cannot be adjudicated because a conflict between particular socio, cultural and historical context, and values and those pre-established rules and norms exists. This problem has, therefore, placed stock (or emphasis) on the judge, the one with a human brain, to solve the complex interpersonal problem beyond, around or within the rules and norms, and therein transform societies.

In some extent, transformations have occurred due to the cognitive process of the brain of a judge, which is the gathering of all of the information and using it (by transforming it, storing it, recovering it, retrieving it, and suppressing it) to operate effectively in the world [15]. Specifically, forgetting is the cognitive process caused, by biological and psychological circumstances, that makes a piece of information not available nor retrievable; while unlearning is the cognitive process, by biological and psychological circumstances, to discard a piece of information or to choose an alternative [16]. Both of these processes have neural benefits on the brain of an individual. One benefit of forgetting is detecting conflict between memories, and another benefit is overcoming competition of set of data through selection and inhibition [17]. These neural benefits allow a judge, when confronted with controversies, outdated pre-established rules, and new values, to choose an alternative, discard or not retrieve a piece of information by way of interpretation or any other legal tool.

Since one of the particular conditions of Machine Learning and/or neural networks is to simulate the brain [18]; the A.I. judge or automated court should be able to forget or unlearn with the purpose of detecting conflict of competing sets of data and overcoming the competition through selection and inhibition. Since the brain of a judge (human) does an enormous amount of cognitive work when adjudicating a dispute, and part of that work is forgetting or unlearning² by way of detecting the conflict and overcome it, either in order to advance the legal system and change course of humanity or in some cases in order to maintain the status quo. Thus, understanding and considering this cognitive work is important at the time of simulating it in an algorithm and designing an A.I. judge or automated court.

Additionally, Machine Learning does not adjust its predictor as new events happen for future recommendations, predictions or suggestions. Its learning method only uses data points from past or old experiences to build a predictor [19]. As such, the complexity of the algorithms and models translates on the lack of capacity to completely forget due to the *lineage* of the data or timely data for prediction [19]. Completely forget means that once a data sample is removed, all its effects on the feature set and the model should be also removed, which is extremely difficult nowadays, since an Artificial Intelligence or its programmer cannot determine which input samples are fed by the already forgotten or unlearned data and its lineage [20]. Besides, timeliness in the learning process refers to the promptness to forget or unlearn an input to be able to update the features and the model system [20], which is extremely difficult nowadays, since Artificial Intelligence can only learn based on the set data provided and/or the programmer can only redefine the algorithm and feed new set of data once the matter has been recognized, meaning after the fact. Thus, forgetting or unlearning is a challenge recognized by computer scientists.

Nevertheless, some have said that if the initial programming permits or encourages the Artificial Intelligence to alter its objectives based on subsequent experiences, those alterations will occur following the dictates of the initial programming [21], and others have advocated results on studies by experimenting with different algorithms and models to have achieved the capability to forget [22]. Despite of this, what computer scientists have been able to accomplish today is creating specific Artificial Intelligence algorithms and Machine Learning to assist other

2. It is true that forgetting or unlearning as a cognitive process are not the only component for a judge to reframe the rules and norms to advance the law, the effects of this cognitive process such as inhibition is the essential result desired, that a AI and ML needs to be able to simulate.

A.I. and M.L. algorithms to forget or unlearn, or retraining data samples for an A.I. system. Thus, forgetting or unlearning is not happening by Artificial Intelligence and Machine Learning automatically nowadays, and requires intervention.

Therefore, the idea of an A.I. Judge or automated court requires a conscious design since it must account for the principles of fairness, impartiality, and effectiveness in conjunction with the statistical methods to learn from data. «It is not simply a matter of ensuring accuracy and perfection in a technical system, but rather a reckoning with the fundamentally imperfect, discriminatory and unfair world from these systems arise, and the underlying structural and historical legacy in which these systems are applied» [23].

4. A.I. & M.L. a new model system for the judiciary – Benefits and Risks?

It has been constantly reiterated that technology is a tool that simply makes the judges or adjudicator's job easier, but it does not change the nature of the duties [14]. However, «with the increasing prominence of large-scale data in all areas of human endeavor has come a wave of new demands on the underlying Machine Learning algorithms» [24], technology supposes not only on expediting the work of the judge but also mutating the role of the judge. Even though it has been argued that Artificial Intelligence and Machine Learning seek to mimic human cognitive processes, the reality is that it seeks «to improve the performance of a machine», and despite the benefits of the technology, the legal profession should keep that idea in mind.

Several arguments are advocating for the benefits or for the risks of designing and deploying an automated court (as listed below). Notwithstanding, I would like to advocate that today, the most important risk is the lack of capacity to forget or unlearn which transpires in the lack of capacity to advance changes in the society; and I emphasize today because computer science is progressing so fast that I foresee Artificial Intelligence and Machine Learning will be able to obtain the proper capacity to reach this goal in the future.

4.1. Benefits

- i. Access to justice. Increasing public (and judicial) access to judgments [25]. A.I. systems can help expand access to courts and legal advice, which too often are luxury goods open only to the well off.
- ii. Standardization. Incentivize a more consistent, standardized way of disposing of cases, both within jurisdictions and across jurisdictions [25].
- iii. Operational efficiency. Efficiency benefits of technology adoption should quantifiably outweigh the upfront cost and the ongoing commitment to maintenance and upgrading of the product [25].
- iv. Transparency. A.I. systems can only make decisions based on the data provided or learned by the algorithm, achieving transparency since it makes it impossible for manipulation or interference on the decision making or prediction process of the technology.

4.2. Risks

- i. Cybersecurity. There are risks related to the protection of a digitized system and the sensitive data contained within it from online attack or hacking [25].
- ii. The problem of bias. The human-generated data used to train machine learning algorithms can be easily tainted by racism, sexism, or other biases. Machine predictions will «learn» what a human would do in a similar situation, which—given poorly prepared training data—all too often means a discriminatory result.
- iii. The loss of control. The loss of control, especially local control, is a significant public risk since it supposes the AI system can no longer be controlled by the human or humans legally responsible for its operation and supervision [21].
- iv. The possibility to exacerbate wealth inequalities in the legal system. Already, access to legal services is doled out according to ability to pay, with money buying higher-quality representation. Artificial Intelligence could supercharge this phenomenon, with only the rich able to buy the latest software, while the rest of us are stuck with wetware humans with their limited memory and processing speed [25].
- v. Lack of trust by the public. The lack of capacity by the Artificial Intelligence algorithms to explain its prediction elucidates a lack of trust, and trust is fundamental for a judicial system to be legitimate and properly serve the public interest [26].

5. The Beijing Internet Court – an AI judge or automated court model

Digitalization of the judicial system has happened already around the globe in many different ways [27], however, the automation of the judicial system via Artificial Intelligence and Machine Learning is still being evaluated and still in early stages. Canada, United Kingdom, Ireland and even the European Court of Justice have implemented some level of digitalization like e-filing, e-conferencing and prediction systems.

However, China is taking the lead on automatization of the judicial system, it has already a few internet courts in the Hanzhou, Beijing and Guangzhou cities. The internet courts integrate technology and judicial practice and share the most benefits with all involving parties [28]. The courts function based on big data, blockchain technology and artificial intelligence [29].

The internet Courts have achieved the deep application of mature technologies such as voice and facial recognition and integrated multiple service platforms of diversified mediation, trial and enforcement, electronic evidence storage and electronic summons delivery [28].

All three internet courts are trial courts within the jurisdiction of their own cities and can handle disputes involving the online sale of goods and services, lending, copyright, and neighboring rights ownership and infringement, product liability claimants, intellectual property and internet public interest litigation brought by prosecutors [30].

For example, the Beijing internet court can automatically generate legal documents for judges. This function is close to an adjudicative function since it is utilizing data gathered, storage and processes to prepare templates and standardized documents, which would be used by judges to decide individual cases. The legal documents can be generated automatically

by using a combination of legal knowledge graph, natural language processing technology, and documents assembly building technology. This application causes the decision-making process of the judge to be quicker and consistent.

Additionally, the Beijing internet court, an online litigation service center, launched an AI judge in July 2019 [31]. However, the AI judge is based on intelligent synthesizing technologies of speech and image, has a female image with a voice, facial expressions and actions based on a real person. Currently, «AI Virtual Judge» can answer 82 consultation questions in four categories [28]. This functionality places the AI judge more like a judicial assistant to the judge than the judge itself; which sets judges free from repetitive work and allows them to devote more energy to case research [31].

The Chinese Internet Courts are indeed the first of its kind in the world. The design took into consideration both the computer science principles and the principles of the judicial system. Every component of the three courts from the online platform, the A.I. legal knowledge graph, blockchain, the cloud, and other features related to the different services it provides for the users are a consideration of the notions of fairness, impartiality, and efficiency, plus the notions of security, transparency, user-friendliness, and satisfaction. Particularly, the human component and its role in the Internet Courts was consciously designed. There is a review process by a judge of the Artificial Intelligence predictions in the cases that litigation is done automated, there is also a review of the document generated with the digital evidence by the A.I. system, and the AI Judge does not replace the adjudicator, it only assists with repetitive tasks but the human judge retains the decision-making process. However, this courts were implemented recently and are still under close scrutiny to properly asses how th role of the judiciary in the Chinese society evolves with it. Thus, understanding that Artificial Intelligence and Machine Learning are determining the future of the judicial system, also it elucidates that the human component of the judicial system, the judge, is an essential part of the judiciary due to the cognitive process unique of the brain that a simulation with a Machine Learning is only that, a simulation.

6. Conclusions

Artificial intelligence, particularly in the form of Machine Learning, is impacting the practice of law, especially the Judicial System, and presents a unique opportunity to address many of the challenges encountered, like bias, inconsistency, exclusion, accessibility, etc. However, the integration of the technologies in the practice of law encounter risks and challenges of the same nature, like bias, accessibility, exclusion, among others, and of new nature, like lack of the human cognitive skills fundamental in the practice of law, particularly in the adjudication of disputes.

Designing an AI judge or an automated court requires considering both the computer sciences and design of dispute resolution mechanism principles. It supposes, then, to appraise that the stages (designing, training, application, and evaluation) of the life cycle of AI «take place in an interactive manner and are not necessarily sequential» [4], which implicate constant reassessment and/or reprogramming, and human intervention for this. It, also, supposes to appraise that a dispute resolution mechanism has to uphold fairness, equality, accessibility, and legitimacy, which implicate a human-centric approach [14].

Since both scientist and engineers say: «We are just beginning to tap the potential synergies and the diversity of formalism and experimental methods across the multiple fields for studying that improves the experience» [1], lawyers and all involved in the practice of law need to be mindful that the «cognitive process» required to imitate the brain of a judge remains at the beginning of the said synergy, among computer sciences and the law.

Therefore, the idea and discussion of an Artificial Intelligent Judge or automated court, despite of not being a futurist idea as the Chinese Courts demonstrate, require that Artificial Intelligence focuses on a different architecture to be properly integrated, or that Machine Learning Algorithm, in particular, designs especial expo-rules to be the workable algorithm to be implemented for an AI judge or automated court; and that the legal community integrate themselves into the computer sciences advances to be able to assure that the role of the judge, as we know it today, is not modified without the proper consideration for our societies.

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